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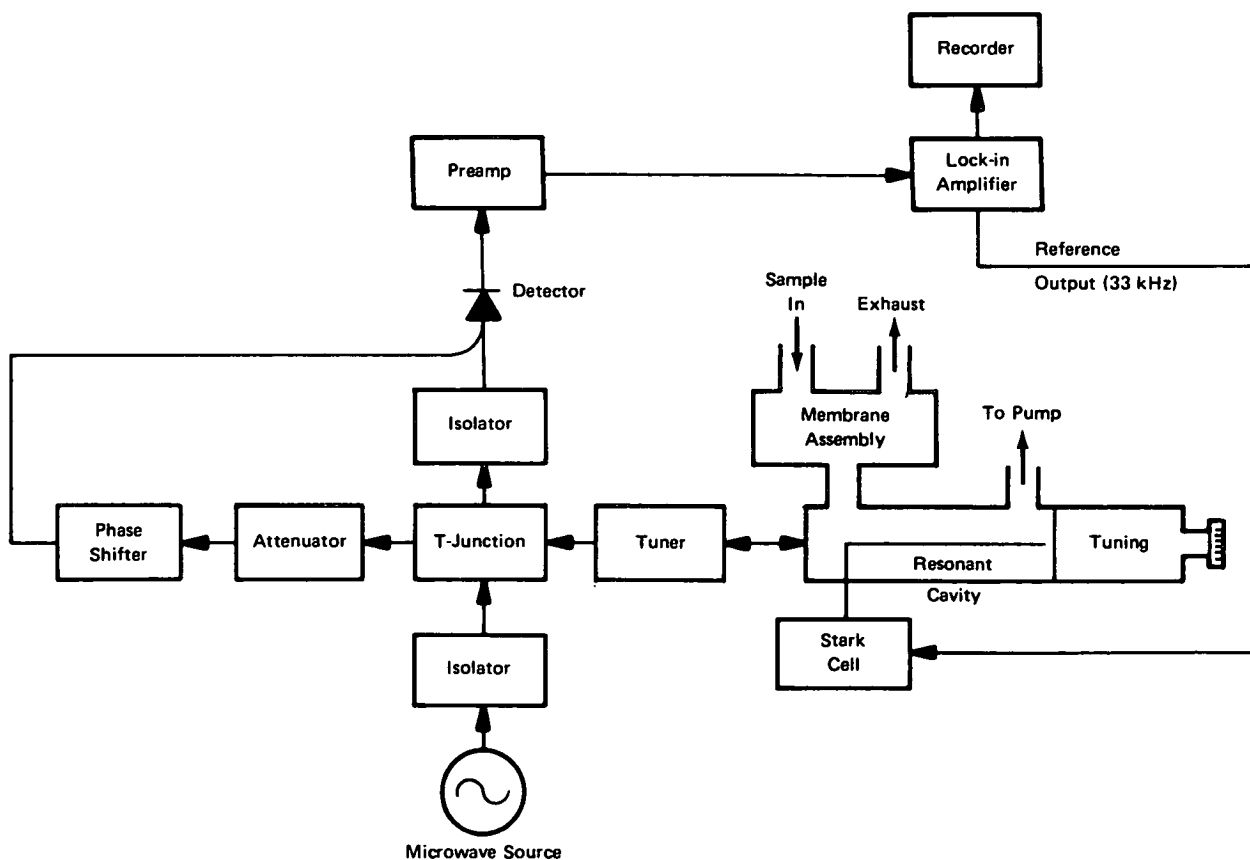
Formaldehyde Monitor for Automobile Exhausts

An instrument for detection of relatively low concentrations of formaldehyde has been constructed and tested in a Langley Research Center laboratory. This unique device makes use of microwave spectral absorption in a low-Q resonant Stark cell, and indications are that the ultimate sensitivity of the instrument is within 100 parts per billion of formaldehyde.

The Stark cell is made from a short length of Ku-band (12,000 to 18,500 MHz) waveguide with re-

flectors placed at each end. Stark modulation is then used, in conjunction with a lock-in amplifier, for detection. A Gunn oscillator is used for the microwave source and is tuned to 28,974.81 MHz, the frequency of a strong formaldehyde-absorption line in Ka-band (26,500 to 40,000 MHz).

The microwave source is very small and requires only a six-volt dc bias for operation. Coarse tuning is accomplished mechanically and fine tuning by adjusting the dc-bias voltage.



Formaldehyde Monitor

(continued overleaf)

Stark modulation and a lock-in amplifier are used for signal detection (see block diagram). The modulation system consists of a small solid-state, square-wave generator and associated power supply. Triggering of the square-wave generator is accomplished with a sine wave from the reference output of the lock-in amplifier. The sine wave is converted to a square wave and amplified.

Microwave power, coupled out of the resonant cavity through the iris, enters the T-junction and is split between the detector arm and the source arm. Power from the cavity which enters the detector arm of the T-junction contains the usable 33 kHz signal. This signal is detected and fed into the amplifier.

An important component of the system is the sample concentrator. It consists of a small section of dimethyl silicone membrane supported by a thin section of perforated stainless steel. The membrane and support are placed between two halves of a teflon holder. The concentrator assembly is connected to the cavity. Nitrogen or air, at atmospheric pressure, containing the formaldehyde to be detected flows past the membrane on the sample-in side. On the other side of the membrane the pressure is much lower due to vacuum in the absorption cell. This pressure drop across the membrane causes gases to pass through it.

The membrane material is much more permeable to formaldehyde than to nitrogen; thus, a significant increase in the formaldehyde concentration relative to nitrogen results in the absorption cell.

Notes:

Requests for further information may be directed to:

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Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

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